

CLAIMS

1. An encoding apparatus for adaptively carrying out field-based or frame-based encoding processing at a macroblock  
5 level with interlaced scan image information as an input, the encoding processing including lossless encoding processing carried out based on a CABAC scheme, the encoding apparatus comprising:

lossless encoding means for carrying out the lossless  
10 encoding processing using a context model corresponding to a frame/field flag indicating whether the encoding processing at the macroblock level is field-based or frame-based, a context model corresponding to a syntax element for carrying out the frame-based encoding processing, and a context model  
15 corresponding to a syntax element for carrying out the field-based encoding processing.

2. The encoding apparatus according to claim 1, wherein the context model corresponding to the syntax element for carrying out the field-based encoding processing includes at  
20 least one of the context models corresponding to an MB\_type for an I picture, an MB\_type for a P/B picture, motion vector information, a reference field parameter, and an intra-prediction mode.

3. The encoding apparatus according to claim 1, wherein an  
25 expression  $\text{ctx\_fifr\_flag}(C) = a + 2ba$  is satisfied,

where  $\text{ctx\_fifr\_flag}(C)$  is a context model related to a frame/field flag of a macroblock C and a and b are the values of frame/field flags of respective macroblocks A and B neighboring the macroblock C.

4. The encoding apparatus according to claim 1, wherein, if a macroblock C included in a P picture is subjected to the field-based encoding, an expression

$\text{ctx\_mb\_type\_inter\_field}(C) = ((A == \text{skip}) ? 0 : 1) + 2((B == \text{skip}) ? 0 : 1)$  is satisfied,

where  $\text{ctx\_mb\_type\_inter\_field}(C)$  is a first context model corresponding to an MB\_type of the macroblock C and  $((A == \text{skip}) ? 0 : 1)$  and  $((B == \text{skip}) ? 0 : 1)$  are operators indicating 0 or 1 depending on whether respective macroblocks A and B neighboring the macroblock C are a Skip mode.

5. The encoding apparatus according to claim 4, wherein, if a macroblock C included in a P picture is subjected to the field-based encoding, Code\_Numbers 0 to 7 corresponding to an MB\_type of the macroblock C are binarized into 0, 100, 101, 11000, 11001, 11010, 11011, and 11100, respectively.

6. The encoding apparatus according to claim 1, wherein, if a macroblock C included in a B picture is subjected to the field-based encoding, an expression

$\text{ctx\_mb\_type\_inter\_field}(C) = ((A == \text{Direct}) ? 0 : 1) + 2((B == \text{Direct}) ? 0 : 1)$  is satisfied,

where  $\text{ctx\_mb\_type\_inter\_field}(C)$  is a first context

model corresponding to an MB\_type of the macroblock C and  
(A==Direct)?0:1) and ((B==Direct)?0:1) are operators  
indicating 0 or 1 depending on whether respective  
macroblocks A and B neighboring the macroblock C are a  
5 Direct mode.

7. The encoding apparatus according to claim 6, wherein, if  
a macroblock C included in a B picture is subjected to the  
field-based encoding, Code\_Numbers 0 to 13 corresponding to  
an MB\_type of the macroblock C are binarized into 0, 100,  
10 101, 11000, 11001, 11010, 11011, 11100, 111000, 1110001,  
1110010, 1110011, 1110100, 1110101, and 1110110,  
respectively.

8. The encoding apparatus according to claim 1, wherein, if  
a macroblock C is subjected to the field-based encoding, an  
15 expression  $\text{ctx\_mvd\_field}(C,k)=0$  if  $e_k(C)<3$ ,  
 $\text{ctx\_mvd\_field}(C,k)=1$  if  $32<e_k(C)$ , or  $\text{ctx\_mvd\_field}(C,k)=2$  if  
 $3\leq e_k(C)\leq 32$  is satisfied,

where  $\text{ctx\_mvd\_field}(C,k)$  is first to third context  
models corresponding to motion vector information of the  
20 macroblock C and  $e_k(C)$  is an evaluation function calculated  
as  $e_k(C)=|\text{mvd}_k(A)|+|\text{mvd}_k(B)|$  where  $|\text{mvd}_k(A)|$  and  $|\text{mvd}_k(B)|$   
are motion vector information of respective macroblocks A  
and B neighboring the macroblock C.

9. The encoding apparatus according to claim 8, wherein the  
25 macroblocks A and B neighboring the macroblock C belong to

the same parity field as that of the macroblock C.

10. The encoding apparatus according to claim 8, wherein,  
if the macroblock C is subjected to the field-based encoding  
and the macroblock X (X is A or B) neighboring the

5 macroblock C has been subjected to frame-based encoding, the  
evaluation function  $e_k(c)$  is calculated by converting the  
vertical component of a motion vector corresponding to the  
macroblock X to the equivalent for field-based encoding  
based on an expression  $mvd_{1\_field}(X) = mvd_{1\_frame}(X) / 2$ ,

10 where  $mvd_{1\_frame}(X)$  is the vertical component of the  
motion vector of the macroblock X.

11. The encoding apparatus according to claim 8, wherein,  
if the macroblock C is subjected to field-based encoding, a  
context model  $ctx\_mvd\_field(C, k)$  is used for a second bin  
15 and a third bin of the motion vector of the macroblock C,  
the context model  $ctx\_mvd\_field(C, k)$  being the same as a  
frame-based context model  $ctx\_mvd(C, k)$ .

12. The encoding apparatus according to claim 1, wherein,  
if a macroblock C is subjected to the frame-based encoding,  
20 an expression  $ctx\_mvd(C, k) = 0$  if  $e_k(C) < 3$ ,  $ctx\_mvd(C, k) = 1$  if  
 $32 < e_k(C)$ , or  $ctx\_mvd(C, k) = 2$  if  $3 \leq e_k(C) \leq 32$  is satisfied,

where  $ctx\_mvd(C, k)$  is first to third context models  
corresponding to motion vector information of the macroblock  
C and  $e_k(C)$  is an evaluation function calculated as

25  $e_k(C) = |mvd_k(A)| + |mvd_k(B)|$  where  $|mvd_k(A)|$  and  $|mvd_k(B)|$  are

motion vector information of respective macroblocks A and B neighboring the macroblock C.

13. The encoding apparatus according to claim 12, wherein, if the macroblock C is subjected to the frame-based encoding and the macroblock X (X is A or B) neighboring the macroblock C has been subjected to field-based encoding, the evaluation function  $e_k(c)$  is calculated by converting the horizontal component and the vertical component of a motion vector corresponding to the macroblock X to the equivalents for frame-based encoding based on expressions

$$mvd_{0\_frame}(A) = (mvd_{0\_top}(A) + mvd_{0\_bottom}(A)) / 2 \text{ and}$$

$$mvd_{1\_frame}(A) = mvd_{1\_top}(A) + mvd_{1\_bottom}(A),$$

where  $mvd_{0\_field}(X)$  is the horizontal component of the motion vector corresponding to the macroblock X and

$mvd_{1\_field}(X)$  is the vertical component of the motion vector corresponding to the macroblock X.

14. The encoding apparatus according to claim 1, wherein, if a macroblock C is subjected to the field-based encoding, expressions  $ctx\_ref\_field\_top(C) = a_t + 2b_t$  and

$ctx\_ref\_field\_bot(C) = a_b + 2b_b$  are satisfied,

where  $ctx\_ref\_field\_top(C)$  is a first context model corresponding to a reference field for a first field of the macroblock C,  $ctx\_ref\_field\_bot(C)$  is a first context model corresponding to a reference field for a second field of the macroblock C,  $a_t$  is a parameter related to a first field of

a neighboring macroblock A,  $a_b$  is a parameter related to a second field of a neighboring macroblock A,  $b_t$  is a parameter related to a first field of a neighboring macroblock B, and  $b_b$  is a parameter related to a second field of a neighboring macroblock B,

where  $a_t$ ,  $a_b$ ,  $b_t$ , and  $b_b=0$  if the reference field is the immediate previous encoded field or  $a_t$ ,  $a_b$ ,  $b_t$ , and  $b_b=1$  if the reference field is not the immediate previous encoded field.

15. The encoding apparatus according to claim 1, wherein, if a macroblock C is subjected to field-based encoding, a context model corresponding to a second bin and a third bin for a first field and a second field of the macroblock C is the same as a context model `ctx_ref_frame(C)` for a macroblock encoded in a frame mode except that a `Code_Number` indicates not a reference frame but a reference field.

16. The encoding apparatus according to claim 1, wherein, if a macroblock C is subjected to the field-based encoding, a context model `ctx_intra_pred_field(c)` for an intra-prediction mode is defined in the same manner as a context model `ctx_intra_pred_field(c)` for the macroblock of the frame mode.

17. The encoding apparatus according to claim 15, wherein, if a macroblock C is subjected to the field-based encoding, a context model `ctx_intra_pred_field(c)` for an intra-

prediction mode is defined in the same manner as a context model ctx\_intra\_pred (c) for the macroblock of the frame mode, regardless of whether the macroblocks A and B neighboring the macroblock C are field mode or frame mode.

5 18. An encoding method for adaptively carrying out field-based or frame-based encoding processing at a macroblock level with interlaced scan image information as an input, the encoding processing including lossless encoding processing carried out based on a CABAC scheme, the encoding  
10 method comprising:

a lossless encoding step of carrying out the lossless encoding processing using a context model corresponding to a frame/field flag indicating whether the encoding processing at the macroblock level is field-based or frame-based, a  
15 context model corresponding to a syntax element for carrying out the frame-based encoding processing, and a context model corresponding to a syntax element for carrying out the field-based encoding processing.

19. A recording medium having a computer-readable program  
20 recorded thereon for adaptively carrying out field-based or frame-based encoding processing at a macroblock level with interlaced scan image information as an input, the encoding processing including lossless encoding processing carried out based on a CABAC scheme, the program comprising:

25 a lossless encoding step of carrying out the lossless

encoding processing using a context model corresponding to a frame/field flag indicating whether the encoding processing at the macroblock level is field-based or frame-based, a context model corresponding to a syntax element for carrying out the frame-based encoding processing, and a context model corresponding to a syntax element for carrying out the field-based encoding processing.

20. A program for adaptively carrying out field-based or frame-based encoding processing at a macroblock level with interlaced scan image information as an input, the encoding processing including lossless encoding processing carried out based on a CABAC scheme, the program enabling a computer to carry out processing comprising:

a lossless encoding step of carrying out the lossless encoding processing using a context model corresponding to a frame/field flag indicating whether the encoding processing at the macroblock level is field-based or frame-based, a context model corresponding to a syntax element for carrying out the frame-based encoding processing, and a context model corresponding to a syntax element for carrying out the field-based encoding processing.

21. A decoding apparatus for decoding image compression information to restore the interlaced scan image information, comprising:

decoding means for decoding the image compression



information that is encoded using a context model  
corresponding to a frame/field flag indicating whether the  
encoding processing at the macroblock level is field-based  
or frame-based, a context model corresponding to a syntax  
5 element for carrying out the frame-based encoding processing,  
and a context model corresponding to a syntax element for  
carrying out the field-based encoding processing.

22. A decoding method for decoding image compression  
information to restore the interlaced scan image information,  
10 comprising:

a decoding step of decoding the image compression  
information that is encoded using a context model  
corresponding to a frame/field flag indicating whether the  
encoding processing at the macroblock level is field-based  
15 or frame-based, a context model corresponding to a syntax  
element for carrying out the frame-based encoding processing,  
and a context model corresponding to a syntax element for  
carrying out the field-based encoding processing.

23. A recording medium having a computer-readable program  
20 recorded thereon for decoding image compression information  
to restore the interlaced scan image information, the  
program comprising:

a decoding step of decoding the image compression  
information that is encoded using a context model  
25 corresponding to a frame/field flag indicating whether the

encoding processing at the macroblock level is field-based or frame-based, a context model corresponding to a syntax element for carrying out the frame-based encoding processing, and a context model corresponding to a syntax element for carrying out the field-based encoding processing.

24. A program for decoding image compression information to restore the interlaced scan image information, the program enabling a computer to carry out processing comprising:

a decoding step of decoding the image compression

information that is encoded using a context model corresponding to a frame/field flag indicating whether the encoding processing at the macroblock level is field-based or frame-based, a context model corresponding to a syntax element for carrying out the frame-based encoding processing, and a context model corresponding to a syntax element for carrying out the field-based encoding processing.